RHENXV
Your Vision, Our Solutions

Switch Mode Power Supply 1000W

HXEF-1000W SERIES

FEATURES

- Wide input voltage range 90-264VAC or 120-370VDC
- Built-in active PFC function
- Accepts AC or DC input
- Support 3+1 parallel redundancy ,current sharing
- Operating ambient temperature range:-40°C To +70°C
- Fan speed automatic adjustable
- High reliability, High efficiency
- Output short circuit, over-current, over-voltage protection, over-temperature protection
- Operating up to 5000m altitude
- 4 years warranty

DESCRIPTION

HXEF-1000-xx is an enclosed AC-DC Switching Power Supply with Universal AC Input with cost effective no load power consumption, high efficiency, high reliability and reinforced insulation also has good EMC performance which meets IEC/EN/BS EN62368, EN/ES/IEC60601, IEC60335, GB4943 standards and widely used in Industrial LED, Electricity, Security, Street Light Control, Telecom & Smart Home Applications.

SELECTION GUIDE

Product Model	DC Voltage (Vo1)	(Vo2)	Rated Current (Io1)	(Io2)	Rated Power	Max. Capacitive Load (μF)
HXEF-1000-12	12V	5V	80A	2A	960W	40000uF
HXEF-1000-15	15V	5V	64A	2A	960W	20000uF
HXEF-1000-24	24V	5V	42A	2A	1008W	10000uF
HXEF-1000-27	27V	5V	37.3A	2A	1007W	8000uF
HXEF-1000-36	36V	5V	28.8A	2A	1008W	6000uF
HXEF-1000-48	48V	5V	21A	2A	1008W	4000uF
HXEF-1000-54	54V	5V	18.7A	2A	1009W	3000uF

INPUT CHARACTERISTICS

Parameter	Units	Model
VOLTAGE RANGE	90 ~264VAC	
	120~370VDC	
FREQUENCY RANGE	47/63Hz	
AVERAGE EFFICIENCY(115/230VAC)	92%	HXEF-1000-12
	92%	HXEF-1000-15
	94%	HXEF-1000-24
	94%	HXEF-1000-27
	94%	HXEF-1000-36
	94%	HXEF-1000-48
	94%	HXEF-1000-54
AC CURRENT(Typ.)	12A/115VAC	
	6A/230VAC	
INRUSH CURRENT(Typ.)	20A/230VAC	
	40A/230VAC	
LEAKAGE CURRENT	<0.5mA/240VAC	

OUTPUT CHARACTERISTICS

Parameter	Units	Model
RIPPLE & NOSE (max.)	200mVp-p	HXEF-1000-12
	150mVp-p	HXEF-1000-15
	200mVp-p	HXEF-1000-24
	150mVp-p	HXEF-1000-27
	200mVp-p	HXEF-1000-36
	200mVp-p	HXEF-1000-48
	200mVp-p	HXEF-1000-54

Parameter	Units	Model
LINE REGULATION	Vo1 ±0.5%, Vo2 ±1.0%	
LOAD REGULATION	±0.5%	HXEF-1000-12
	±0.5%	HXEF-1000-15
	±0.5%	HXEF-1000-24
	±0.5%	HXEF-1000-27
	±0.5%	HXEF-1000-36
	±0.5%	HXEF-1000-48
	±0.5%	HXEF-1000-54
SHORT CIRCUIT PROTECTION	Protection type: Hiccup mode, recovers automatically after fault condition is removed	
OUTPUT VOLTAGE ACCURACY	VO1 ±1, VO2 ±2%	
RISE TIME	50ms/230VAC at full load	
	50ms/115VAC at full load	
HOLD UP TIME (Typ.)	12ms at full load	

PROTECTION

Parameter	Units	Model
SHORT CIRCUIT	Protection type: Hiccup mode, recovers automatically after fault condition is removed	
OVER LOAD	105%-150% Rated Output Power Protection type: Hiccup mode, recovers automatically after fault condition is removed	
OVER VOLTAGE	12V: ≤16.5V	HXEF-1000-12
	15V: ≤21.0V	HXEF-1000-15
	24V: ≤35.0V	HXEF-1000-24
	27V: ≤35.0V	HXEF-1000-27
	36V: ≤48.0V	HXEF-1000-36
	48V: ≤60.0V	HXEF-1000-48
	54V: ≤63.0V	HXEF-1000-54
OVER TEMPERATURE PROTECTION	Over-temperature protection activation @ 70°C	
	Over-temperature protection deactivation @ 50°C	

ENVIRONMENT

Parameter			Min.	Typ.	Max.	Units
WORKING TEMPERATURE	-40°C to +70°C (Refer to "Derating Curve")					
WORKING HUMIDITY	20~90% RH Non-Condensing					
STORAGE TEMP, HUMIDITY	-40°C~+85°C, 10~95% RH non-condensing					
TEMP COEFFICIENT	±0.03%/°C(0~50°C)					
SAFETY PROTECTION	CLASS I					
SWITCHING FREQUENCY	PFC rated output @ 65 kHz					
	LLC rated output @ 85 Khz					
MTBF	250K hrs min. MIL-HDBK-217F(25°C)					
ISOLATION LEVEL	Input - output		2 × MOPP			
	Input - ⏚		1 × MOPP			
	Ouput - ⏚		1 × MOPP			
POWER DERATING OPERATING TEMPERATURE		-40°C To -30°C	5	--	--	%/°C
	12V/15V	+45°C To +70°C	1.6	--	--	
	24V/27V /36V/ 48V/ 54V	+50°C To +70°C	2	--	--	
	24V/27V /36V/ 48V/ 54V					
ISOLATION	Input-Output	ELECTRIC STRENGTH TEST FOR 1MIN., LEAKAGE CURRENT <10MA	4000	--	--	VAC
	Input- ⏚		2000	--	--	
	Output - ⏚		1500	--	--	
INSULATION RESISTANCE	Input - Output	ENVIRONMENT TEMPERATURE: 25±5°C RELATIVE HUMIDITY: <95% RH, NON-CONDENSING TESTING VOLTAGE: 500VDC	100	--	--	MΩ
	Input - ⏚		100	--	--	
	Output - ⏚		100	--	--	

EMC CHARACTERISTICS

	Parameter	Category	Content	
EMI	CE	CISPR32 / EN55032		CLASS B
	Harmonic Current	EN61000-3-2		CLASS A
	RE	CISPR32 / EN55032		CLASS B
EMC	ESD	IEC/EN61000-4-2	Contact ±8KV/Air ±15KV	perf. Criteria A
	RS	IEC/EN61000-4-3	80MHz–1GHz 10V/m	perf. Criteria A
	EFT	IEC/EN61000-4-4	±2KV	perf. Criteria A
	Surge	IEC/EN61000-4-5	line to line ±2KV/line to PE±4KV	perf. Criteria A
	CS	IEC/EN61000-4-6	GB/T17626.2 Contact ±6KV, Air ±8KV	perf. Criteria A
	Voltage dips, short Interruptions and voltage variations	IEC/EN61000-4-11	0%,70%	perf. Criteria B

DIMENSION, WEIGHT & PACKING

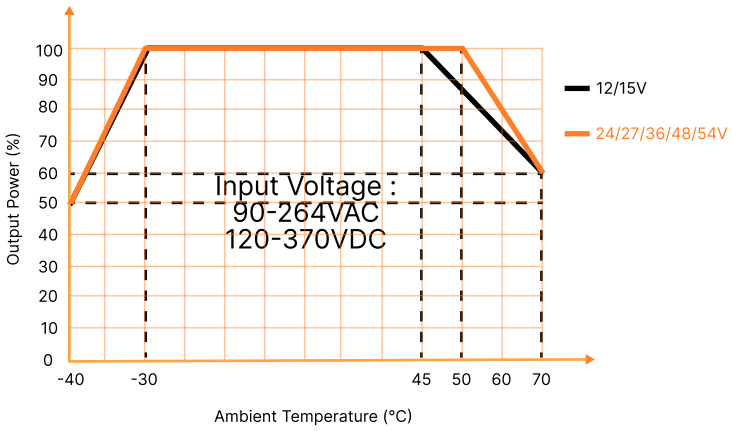
Parameter	Units
OVERAL DIMENSIONS :	190.00 × 127.00 × 40.50mm (LxWxH)
WEIGHT :	1250g (Typ.)
COOLING MODE :	FORCED AIR COOLING
HOUSING MATERIAL :	SUS304

GENERAL CHARACTERISTICS

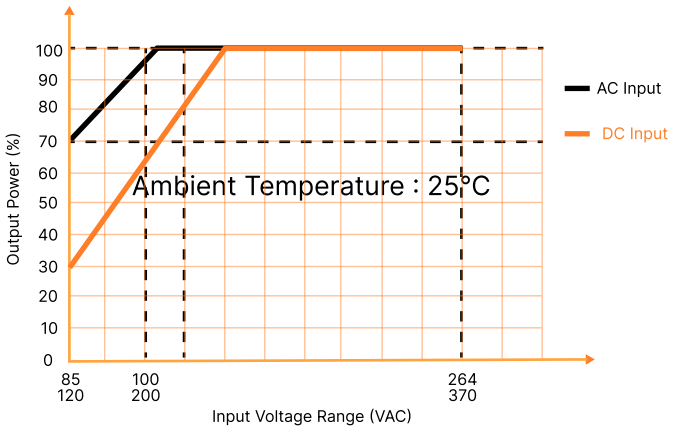
Parameter	Operating Conditions		Min.	Typ.	Max.	Units
ORING			SUPPORTS DIRECT PARALLEL USE, ACHIEVE 3+1 PARALLEL REDUNDANCY			
REMOTE CONTROL SWITCH	ALL INPUT VOLTAGE RANGE, ALL LOAD RANGE	POWER ON	PS_ON (CN7,PIN6) AND GND (CN7,PIN7/14) ARE SHORTED			
		POWER OFF	PS_ON (CN7,PIN6) AND GND (CN7,PIN7/14) ARE OPEN			
CURRENT SHARING ACCURACY	OUTPUT >50%IO1		--	±5	--	%

Parameter	Operating Conditions		Min.	Typ.	Max.	Units
LED SIGNAL	MAIN OUTPUT STATUS INDICATION	NORMAL OUTPUT	GREEN ON			
		ABNORMAL OUTPUT, PROTECTED	RED ON			
		POWER OFF (AC WITH OUT INPUT)	LIGHT OFF			
DC OK SIGNAL	ALL INPUT VOLTAGE RANGE, ALL LOAD RANGE	POWER ON	2.5	--	5	V
		POWER OFF	--	--	0.5	
SDA, SCL FOR I2C			INTERNAL 2.4KΩ PUL-UP RESISTOR TO INTERNAL 3.3V			
REMOTE SENSE	TOTAL COMPENSATE VOLTAGE, VS+/VS- (CN7 PIN1/8) SHORTED TO VO+/VO- RESPECTIVELY		--	200	--	mV

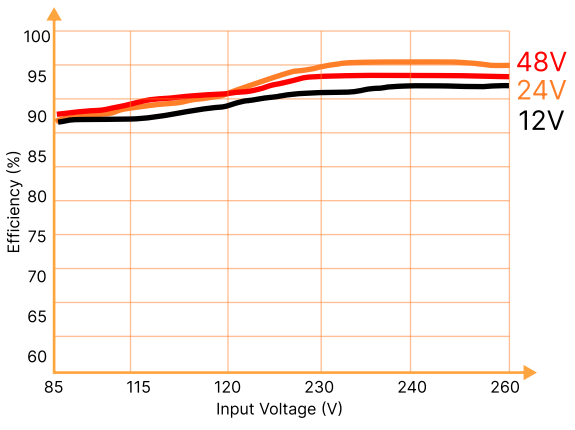
PRODUCT CHARACTERISTIC CURVE



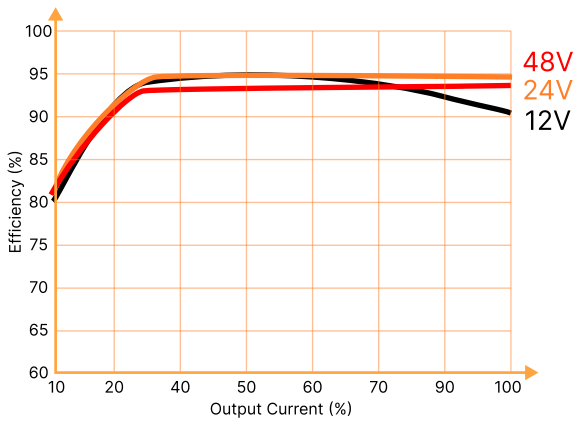
Temperature Derating Curve



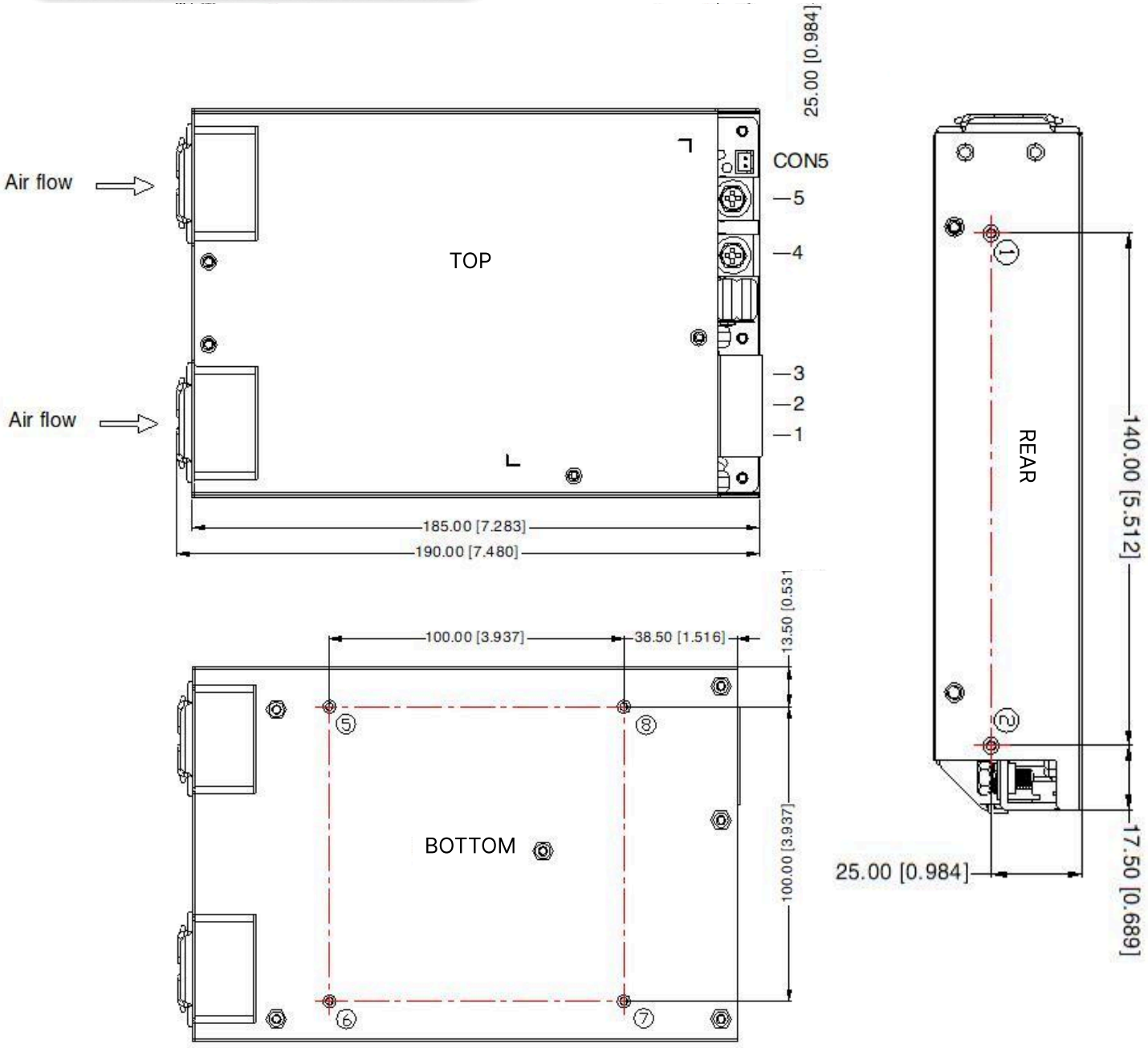
Input Voltage Vs Output Power



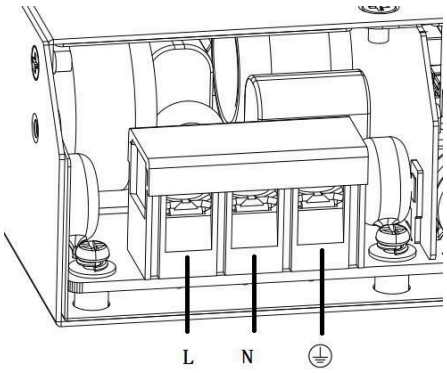
Efficiency Vs Input Voltage (Full Load)



Efficiency Vs Output Load (Vin=230VAC)



Pin - Out				Customer Connector
Pin	Mark	Pin	Mark	
1	VS+	8	VS-	
2	CURRENT SHARE	9	ADDRESS0	Connector:JST PHDR-14Vs Or Equivalent Terminal: JST SPHD-002T-P0.5
3	DC_OK	10	ADDRESS1	
4	SCL	11	ADDRESS2	
5	SDA	12	RXD	
6	PS_ON	13	TXD	
7	GND	14	GND	

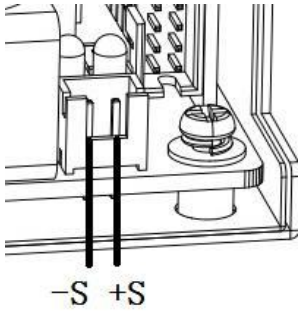


AC/DC INPUT TERMINAL BLOCK (J1)

The input terminal J1,
as a standard 3-pin fence welding terminal with upper cover, the center spacing of the pins is 10mm

WIRE SIZE: 12-22AWG
TORQUE: 1.2N·M (MAX

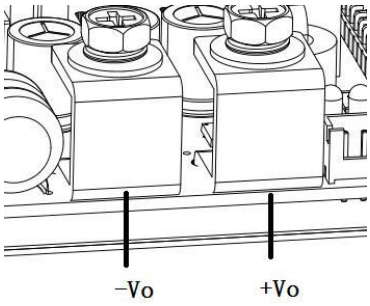
PIN	Features
L	Line(Phase)
N	Neutral
⏚	Ground/Earth



AUXILIARY DC OUTPUT TERMINAL (CON5)

The auxiliary output terminal with a standard terminal of 2.5mm pitch.

PIN	Function
-S	Auxiliary DC Output -
+S	Auxiliary DC Output +

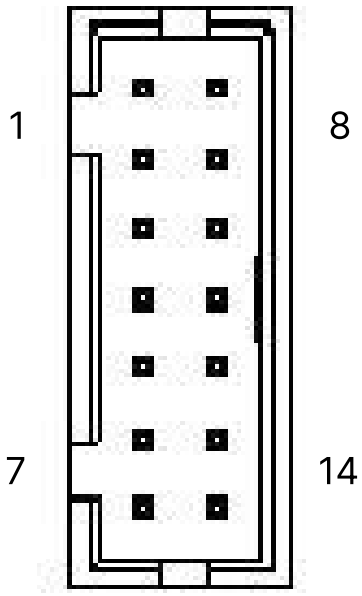


MAIN DC OUTPUT TERMINAL (J2, J3)

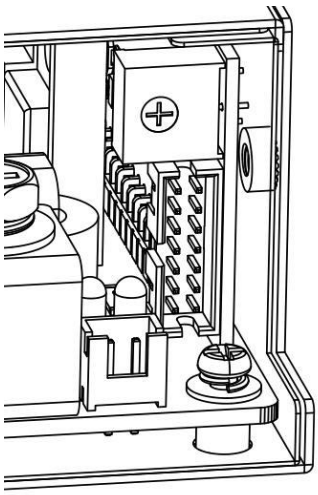
The output terminal uses two standard screw lock type metal terminals, the pin spacing between each is 18mm.

TORQUE: 2.3N·M

PIN	Features
+Vo	Main Output +
-Vo	Main Output -



PIN	Label	Features
1	VS+	Remote Compensation Positive End
2	CURRENT SHARE	Current Sharing Bus
3	DC_OK	DC_OK Signal
4	SCL	I2C Communication Line
5	SDA	I2C Communicationline
6	PS_ON	Remote Control Signal
7	GND	Signal Terminal Reference Ground
8	VS-	Remote Compensation Negative Terminal
9	ADDRESS0	ADDRESS Code 0
10	ADDRESS1	ADDRESS Code 1
11	ADDRESS2	ADDRESS Code 2
12	RXD	Serial Communication
13	TXD	Serial Communication
14	GND	Signal Terminal Reference Ground



OUTPUT VOLTAGE ADJUSTMENT KNOB

TURN COUNTERCLOCKWISE TO INCREASE OUTPUT VOLTAGE

Model	Rated Output Voltage	Adjustable Range Of Output Voltage
HXEF-1500-12	12V	12-14.4V
HXEF-1500-15	15V	15-18V
HXEF-1500-24	24V	24-28.8V
HXEF-1500-27	27V	27-32.4V
HXEF-1500-36	36V	36-43.2V
HXEF-1500-48	48V	48-56V
HXEF-1500-54	54V	54-58V

GREEN AND RED STATUS DISPLAY LED LIGHTS

Green LED	Red LED	Status
ON	OFF	Normal Work
OFF	ON	Main Or Auxiliary Road Alarm
OFF	OFF	No AC Input

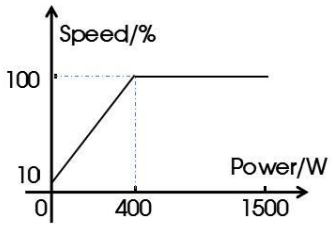
INPUT REQUIREMENTS

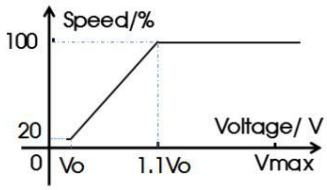
the ac input voltage and dc input voltage must be within the defined voltage range (refer to data-sheet), otherwise the power supply may not work properly or even malfunction. the internal l and n line of the power module have been connected in series with a 250v 25a fuse. for better protection, it is recommended that customers use a circuit breaker not greater than 25a (non-mandatory requirement).

OUTPUT REQUIREMENTS

Main output At any voltage value, the maximum output current and power must not exceed the rated/specified value. The output current must not exceed the maximum output current value. Auxiliary output

The auxiliary circuit supports a maximum current of 2A.

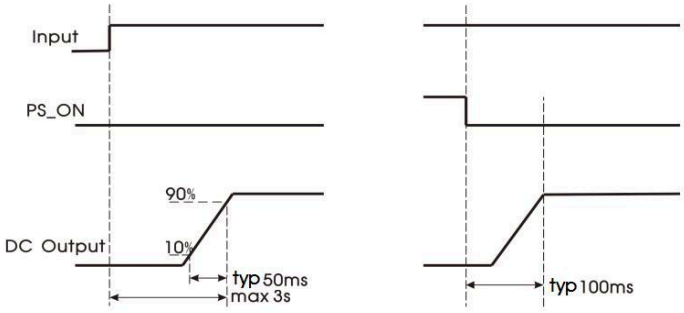




FAN SPEED CONTROL

Fan speed is determined by output power and output voltage at the same time, refer to the foLlowing curve for fan speed change.

START-UP TIMING



Item	Operating Conditions		Min.	Typ.	Max.	Unit
Power-Off Hold Time	Room Temperature Full Load	115VAC output	--	12	--	ms
		230VAC Output	--	12	--	
Start Delay Time	230VAC, Ful Load, 25°C		--	--	3	s

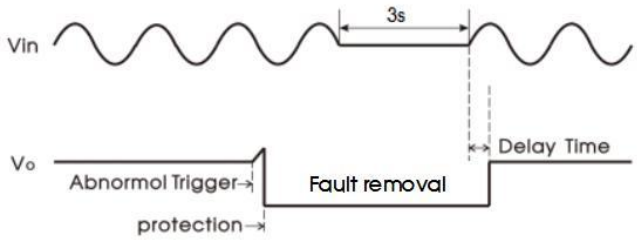
OUTPUT OVER-VOLTAGE PROTECTION (OVP)

Main output

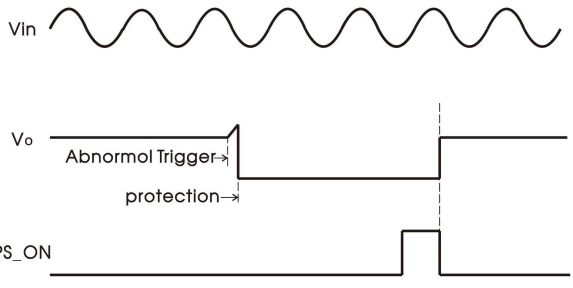
The over-voltage protection function is to close the main output when the output voltage reaches the protection voltage value.

When the main circuit over-voltage protection occurs, the main circuit output voltage of the module will be shut off, and the auxiliary circuit output will not be affected.

The main circuit output can be restored after disconnecting the input power for at least 3 seconds.

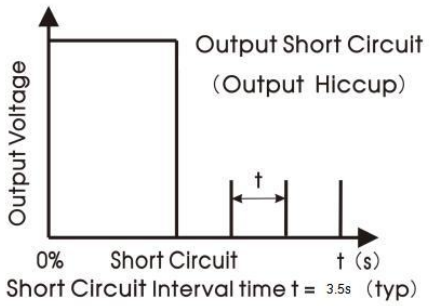


In addition, it can be quickly restarted by the PS_ON signal:



Auxiliary output

When the auxiliary circuit voltage reaches 6.3VDC (maximum value), the auxiliary output will be in hiccup status, and the main output voltage turn off until the auxiliary output returns to normal after the fault is eliminated.

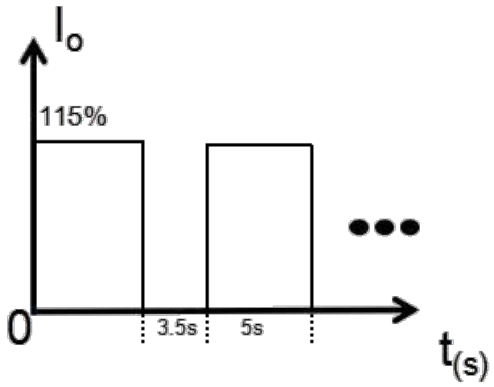


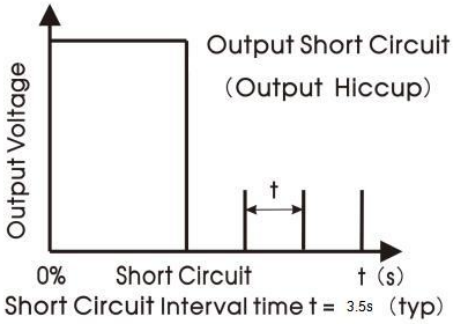
OUTPUT SHORT CIRCUIT PROTECTION (SCP)

Main circuit overcurrent If in CC load mode, when the current exceeds the constant current point, the output enters hiccup mode; when the over current state is released, the output returns to normal. If in CR/CV load mode, the relationship among output current, voltage and resistance in shown in the fo lowing curve:

OUTPUT CONSTANT-CURRENT PROTECTION (OCP)

Main circuit overcurrent If in CC load mode, when the current exceeds the constant current point, the output enters hiccup mode; when the over current state is released, the output returns to normal. If in CR/CV load mode, the relationship among output current,
voltage and resistance in shown in the fo lowing curve





When the product enters the constant current state, the output state circulates as shown in Fig.1, working for 5S and protecting for 3.5S, until the constant current state is released.

In that above Fig.2 the slope corresponding to section R1-R2 is the output current corresponding to constant current. Generally V 175 V %

② Auxiliary circuit overcurrent.
When the auxiliary output current exceeds 120% (typ.) of the rated current, turn off the main output. After the overflows state is removed, the main route automaticaly recovers output after restart.

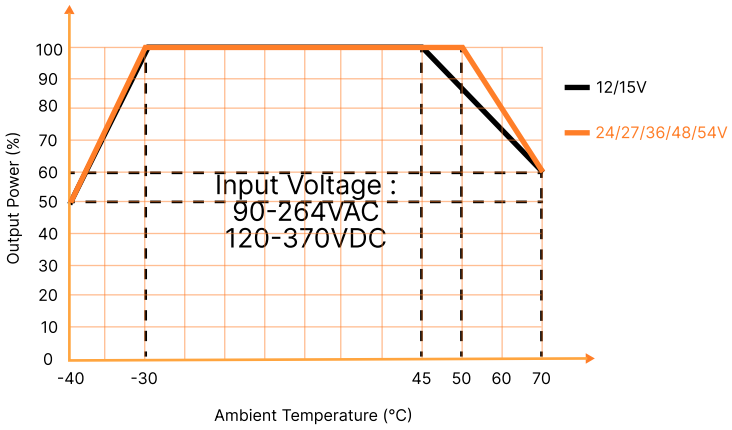
OVER-TEMPERATURE PROTECTION (OTP)

When the ambient temperature of the power supply exceeds the rated temperature for a period of time, the power supply will be turned off and the power supply will resume normal operation after the ambient temperature drops to the set value.

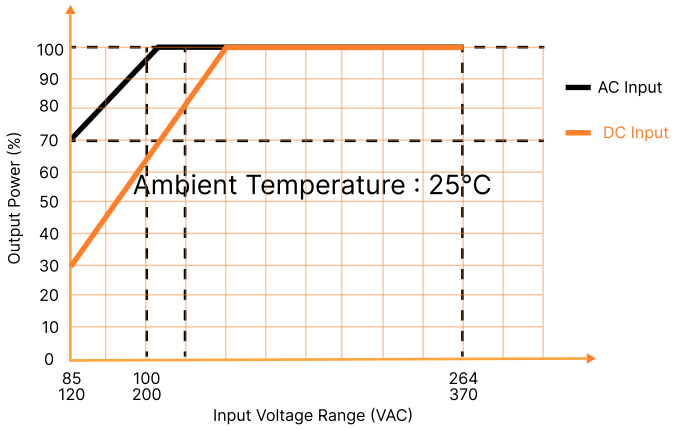
OUTPUT POWER DERATING

When the input voltage is greater than 100VAC (or 200VDC), only need to derate according to the temperature derating curve.

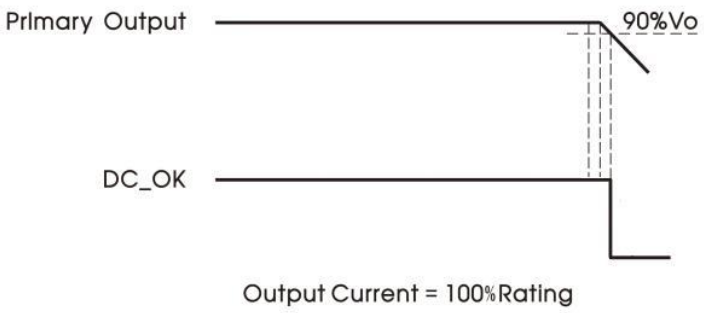
When the input voltage is lower than 100VAC (or 200VDC), the output power will be derated according to the following input voltage derating curve after temperature derating.

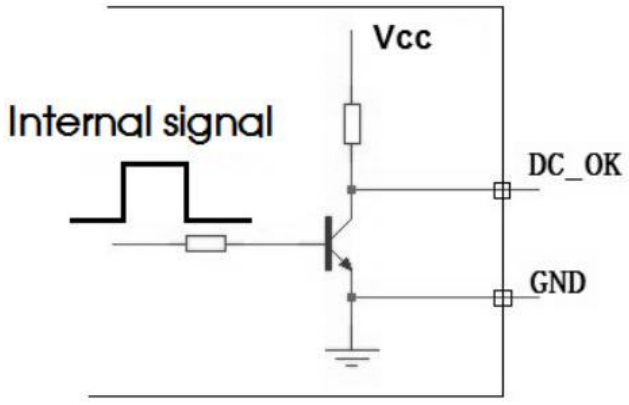


Temperature Derating Curve



Input Voltage Vs Output Power





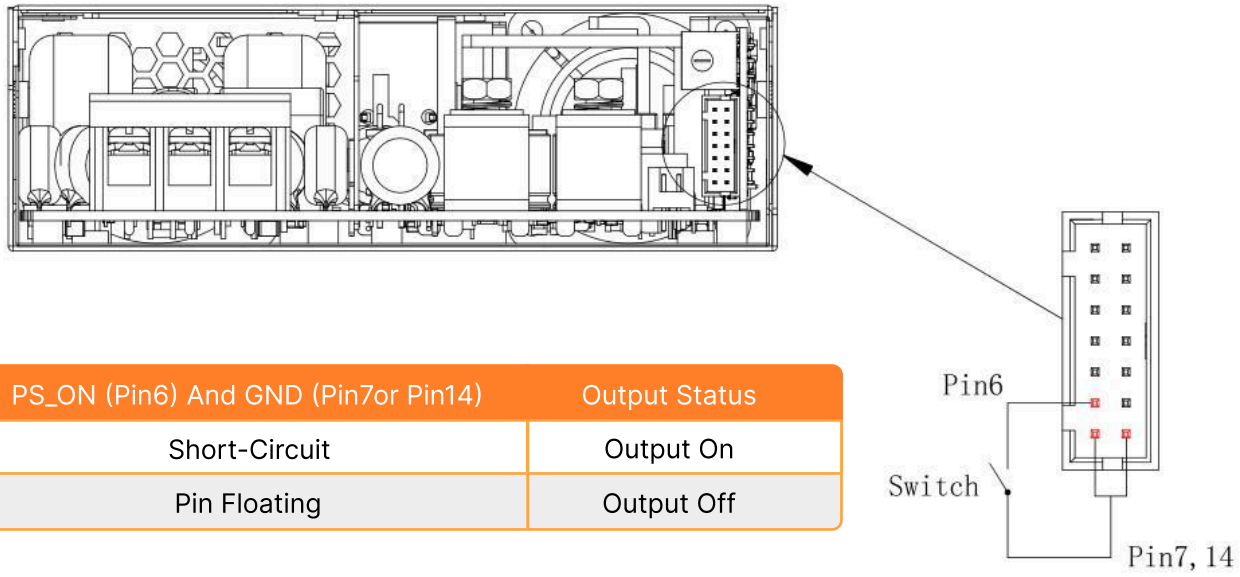
DC_OK SIGNAL

The DC_OK signal is used to monitor whether the power supply is working normally, and the signal is at Pin3 of the signal terminal CN7.

Note: When the DC_OK signal is connected to the external circuit, the impedance of the external circuit (i.e. between Pin3 and Pin7 or Pin14 of CN7) is not less than 10kΩ

DC_OK (Pin3) And GND (Pin 7 Or Pin 14)	Output Status
2.5 - 5V	Output On
0 - 0.5V	Output Off

REMOTE CONTROL

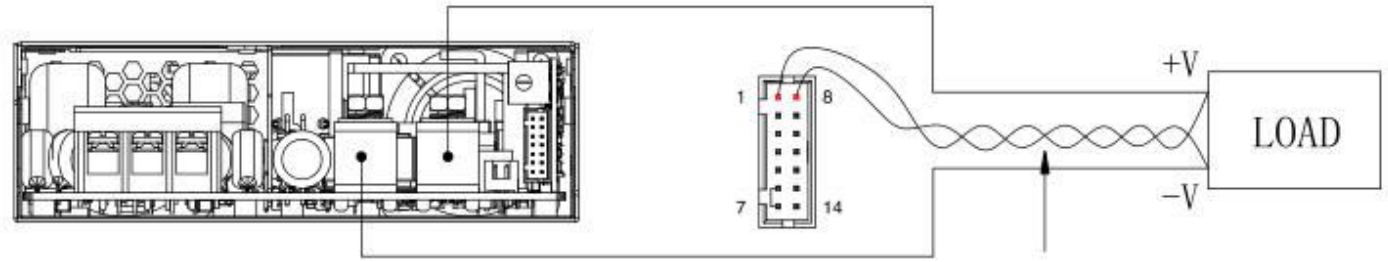


PS_ON (Pin6) And GND (Pin7or Pin14)	Output Status
Short-Circuit	Output On
Pin Floating	Output Off

If the input terminal of the power module has been connected to a power source, the PS_ON signal pin can be used to control the on and off of the main output, and the PS_ON signal does not affect the output voltage of the auxiliary circuit.

Note: The internal PS_ON input impedance of the module is 5.1K.

REMOTE COMPENSATION



Note: INTERLEAVE

1. Vs+ and Vs- cannot be shorted or reversed, otherwise the power module will be damaged.

2. Before powering on the product, please confirm whether the control signal connection terminal (CN7) Pin6 (PS_ON) and Pin7 (GND) short-circuit jumper cap are connected. If not, the product without output. When the control signal connection terminal (CN7) of the product are external connected as a whole, please ensure that Pin6 and Pin7 (or Pin14) are short-circuit connected.

3. Pin 1 and pin 8 of the signal terminal CN7 can compensate the voltage drop on the output cable.

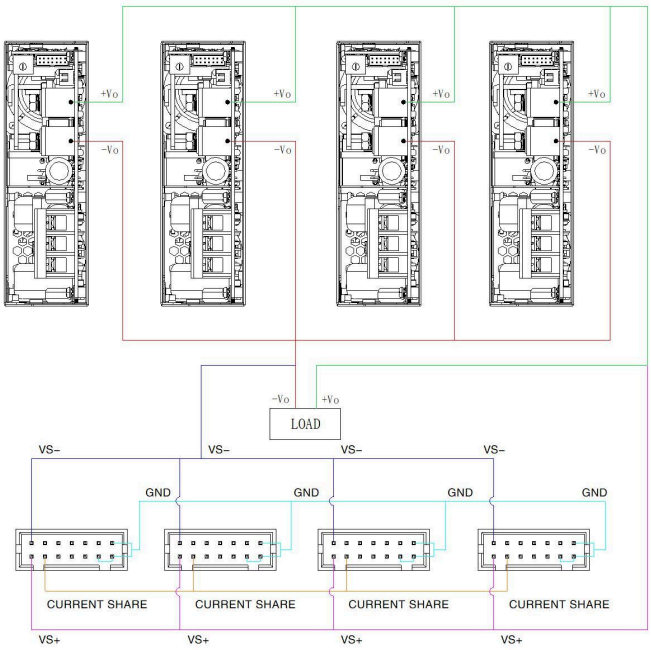
4. The remote compensation circuit can compensate up to 200mV cable voltage drop. This voltage includes the sum of the cable drop connected to the output positive terminal and the output negative terminal.

5. If you need to use the remote compensation function, the signal pin needs to be connected with the load end with a twisted pair cable.

PARALEL OPERATION CURRENT SHARING

METHOD 1

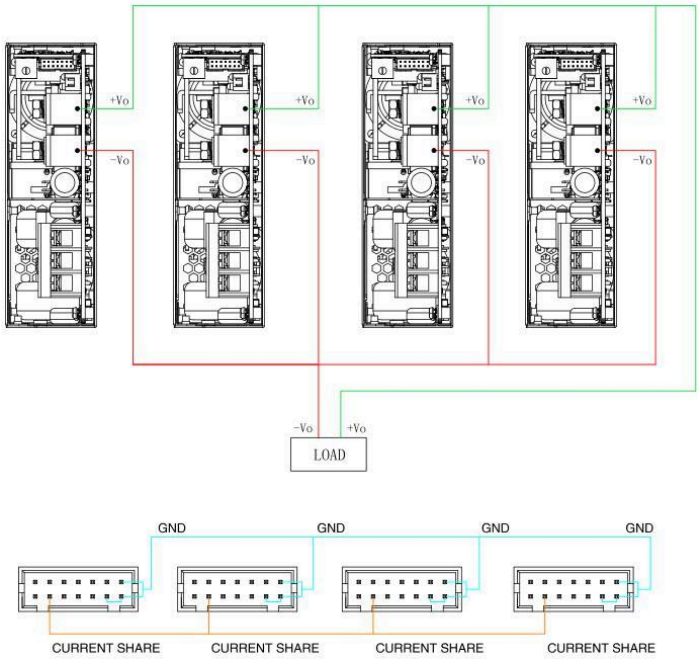
Current sharing bus and remote compensation lines are both connected.



For load line loss ≤ 200mV, and the output voltage difference of each single module ≤ 50mV, this type of connection is recommended to obtain a better line-end output voltage and current sharing effect.

METHOD 2

Only the current sharing bus is connected, and the remote compensation is not connected.



For the load line loss ≥ 200mV, or the output voltage difference of each single module cannot or does not need to be accurately adjusted to ≤ 50mV, this type of connection is recommended to obtain a better current sharing effect of the parallel machine. In the same way, when the load loss is unknown or the current sharing fails to meet the specifications under the first connection method, it is recommended to replace it with this connected method. The wiring method of the current sharing function is shown in the figure Above

Note:

1. When using in parallel, the number of parallel modules cannot exceed 4.

2. Before powering on the product, please confirm whether the control signal connection terminal (CN7) Pin6 (PS_ON) and Pin7 (GND) short-circuit jumper cap are connected. If not, the product without output. When the control signal connection terminal (CN7) of the product are external connected as a whole, please ensure that Pin6 and Pin7 (or Pin14) are short-circuit connected.

When power modules work in parallel, there is an internal active current sharing circuit to ensure that the current between each module is balanced.

The active current sharing circuit adopts the automatic master-slave current sharing method. Each power module has a current sharing bus signal (CURRENT SHARE BUS). When working in parallel, the current sharing bus of al power modules must be connected together.
The current-sharing bus signal is located at pin 2 of CN7

The output voltage of each power module will affect the current sharing accuracy. The output voltage of the power module is the rated voltage ±50mV.

In practical applications, if the output voltage value needs to be adjusted, the output voltage of al parallel power supply modules needs to be adjusted to the same voltage. The recommended voltage range: target voltage value ±50mV

After the output load of each power module is greater than 50% of the rated load, the current sharing accuracy should be ±5%. The current sharing calculation formula is:

$$\text{CURRENT SHARING ACCURACY} = \frac{\text{IO MAX - IO MIN}}{\text{IO MAX}} \text{ X } 100\%$$

Iomax: the maximum output current value in parallel power supply modules.
Iomin: the minimum output current value in parallel power supply modules.

REDUNDANCY

The power module output can be connected in parallel to achieve redundancy, thereby improving system reliability. The maximum power of the redundant system needs to be derated to ensure that the redundant system can sti l meet the rated load requirements when a power supply module fails. The current common practice is to construct a redundant system by the N+1 method, that is, N+1 power supplies are connected in parallel, to support the maximum load current N*Io max, where Io max is the rated output current of each power supply. For example, the rated output current of each power supply is 40A, and 3+1 units are connected in parallel to construct a 3*40A=120A redundant system.

The power module supports 3+1 parallel redundant operation. The ORing circuit is used inside the power module, and when any one of the power modules in the parallel fails, it will not affect the work of other power modules.

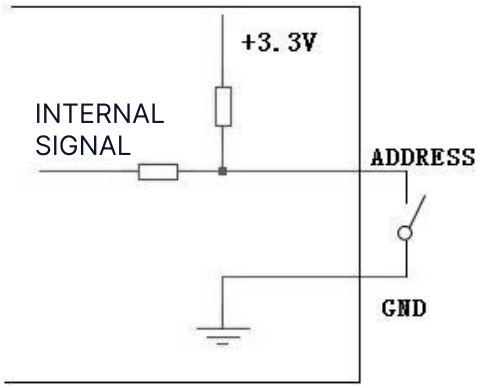
When used in parallel, the maximum load current cannot exceed the maximum output current of a single power supply module, otherwise the whole parallel power supply module will not start normally.

I2C COMMUNICATION ADDRESS

In the parallel system, if you need to identify the power module information, you need to set the I2C communication address for each parallel power module, and exchange data with the host computer through I2C. The setting of the communication address is determined by pins 9, 10 and 11 of the signal terminal CN7.

When these three pins are short-circuited with pin 7 or 14 of CN7, it will be low level (L, voltage range: 0- 1.31V). When disconnected, it is high level (H, voltage range: 1.99V- 3.3V)， one bus can match up to 7 prototypes for communication. The specific address number is shown in the table below

ADDRESS 2	ADDRESS 1	ADDRESS 0	ADDRESS Number
L	L	L	0
L	L	H	1
L	H	L	2
L	H	H	3
H	L	L	4
H	L	H	5
H	H	L	6
H	H	H	7



The internal pul-up resistance value of the power module is 10kΩ, and the external impedance can be matched according to the actual application to meet the high and low voltage range.

COMMUNICATION PROTOCOL

The HXEF-1500-xx series power modules support standard communication protocols and manage and monitor the power modules through I2C bus.

Command Code	Command Name	Access Type	Date Bytes	Data Format	Description
0×9A	PMB_MFR_MODEL	Block Read	32	ASCII	Product Model
0×8B	PMB_READ_VOUT	Read Word	2	Direct	Main Circuit Output Voltage (10mV)
0×8C	PMB_READ_IOUT	Read Word	2	Direct	Main Output Current(10mA)
0×96	PMB_READ_POUT	Read Word	2	Direct	Main Output Power(100mW)
0xC4	PMB_MFR_AUX_VOUT	Read Word	2	Direct	Auxiliary Output Voltage(10mV)
0xC5	PMB_MFR_AUX_IOUT	Read Word	2	Direct	Auxiliary Output Current (10mA)
0xC7	PMB_MFR_FAULT_BIT	Read Word	2	Bit Field	Fault Status Word

Bit Segment	Description
BIT: 0	0: Fan 1 Normal 1: Fan 1 Fault
BIT: 1	0: Fan 2 Normal 1: Fan 2 Fault
BIT: 2	0: Auxiliary Output Normal 1: Auxiliary Output Abnormal
BIT: 3	0: No Over-Voltage In Main Circuit 1: Over-Voltage In Main Circuit
BIT: 4	0: No Under-Voltage In Main Circuit 1: Under-Voltage In Main Circuit
BIT: 5	0: No Level 1 Over-Current In Main Circuit 1: Level 1 Over-Current In Main Circuit
BIT: 6	0: No Level 2 Over-Current In Main Circuit 1: Level 2 Over-Current In Main Circuit
BIT: 7	0: No Level 1 Over-Load In Main Circuit 1: Level 1 Over-Load In Main Circuit
BIT: 8	0: No Level 2 Over-Load In Main Circuit 1: Level 2 Over-Load In Main Circuit
BIT: 9	0: No Level 3 Over-Load In Main Circuit 1: Level 3 Over-Load In Main Circuit
BIT: 10	0: Normal Temperature 1: Over-Temperature And Over-Load
BIT: 11	0: No Short Circuit In Main Circuit 1: Short Circuit In Main Circuit
BIT: 12	0: No Hardware Over-Voltage In Main Circuit 1: Main Circuit Hardware Over-Voltage Fault
BIT: 13	0: No Hardware Under-Voltage In Main Circuit 1: Main Circuit Hardware Under-Voltage Fault
BIT: 14	0: Pre-Charge Normal 1: Pre-Charge Fault
BIT: 15	0: PFC Soft Start Normal 1: PFC Soft Start Fault